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(54) Transmission power control in a CDMA/TDD radio communication system

Sendeleistungsregelung in einem CDMA/TDD Funkübertragungssystem

Contrôle de la puissance de transmission dans un système de communication AMDC/TDD

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Description

[0001] The present invention relates to a CDMA/TDD radio communication system according to the preamble portion of claim 1.

[0002] Demand for land mobile communication such as a car telephone and a portable telephone is increasing remarkably, and frequency effective utilization technique for securing larger subscriber's capacity in a limited frequency band have become important in recent years. A code-division multiple access (CDMA) system attracts attention as one of multiple access systems for frequency effective utilization. In the CDMA system, when a signal level from a mobile unit near a base station is high in a reverse link from the mobile unit to the base station, such a near-far problem that a signal from another mobile unit become unreceivable is generated. Thus, it is required to control transmission power of the mobile unit so that the base station receives the signal from any mobile unit at the same level.

[0003] On the other hand, since propagation conditions both for transmission and reception are the same in a time division duplex (TDD) system in which transmission and reception are performed in the same frequency band, when propagation condition on one side is known, propagation condition on the other side can be known. With this, it is possible to measure the reception power at the mobile unit and to control the transmission power of the mobile unit based on the measured value.

[0004] Transmission power control techniques in a conventional CDMA/TDD radio communication system will be described hereinafter with reference to Fig. 1. In Fig. 1, reference numeral 1 represents a base station, 2 a mobile unit, 3 a data channel spreading circuit for spreading a first transmitted data 11 from the base station 1, 4 a despreading circuit for obtaining a first received data 12, 5 a transmission line, 6 a data channel despreading circuit for obtaining a second received data 13 in the mobile unit 2, 7 a data signal reception level measuring circuit for measuring the level of the second received data 13, 8 a transmission power control circuit for controlling the transmission power of the mobile unit in accordance with the reception level, 9 a spreading circuit for spreading a second transmitted data 14 from the mobile unit 2, 10 a power amplification circuit.

[0005] Next, the operation of the conventional example described above will be explained. In the base station 1, the first transmitted data 11 are spread by means of the data channel spreading circuit 3. The spread signal is transmitted to the mobile unit 2 through the transmission line 5 after being added to the spread signals of other channels. The signal received by the mobile unit 2 is despread in the data channel despreading circuit 6 to obtain the second received data 13. In the data signal reception level measuring circuit 7, the reception level is measured with the second received data 13. In the transmission power control circuit 8, attenuation in the transmission line 5 is estimated based on the measured value of the reception level to determine the transmission power when the mobile unit 2 spreads the second transmitted data 14 by the spreading circuit 9 and transmits those data after amplification in the power amplification circuit 10. The data transmitted from the mobile unit 2 through the transmission line 5 are despread by the despreading circuit 4 in the base station 1 to obtain the first received data 12. When the power level of the first transmitted data 11 transmitted from the base station 1 is constant, it is possible to obtain the attenuation of the transmission line 5 accurately, so that it is possible to control the transmission power of the mobile unit 2 accurately.

[0006] In the conventional transmission power control techniques described above, however, it is impossible to obtain the attenuation of the transmission line 5 accurately and to control the transmission power accurately when the transmission power level of the first transmitted data 11 changes. Further, the attenuations of the transmission line 5 estimated in respective mobile units 2 are different due to the fact that the contents of the transmission data transmitted from the base station 1 to respective mobile units 2 are different from one another and separate spreading codes are used, respectively, and the transmission power of respective mobile units 2 is determined based on the estimated attenuation of the transmission line 5. Thus, the power arriving at the base station 1 from respective mobile units 2 becomes uneven.

[0007] GB-A-2268365 discloses a CDMA/TDD communication system according to the preamble part of claim 1.

[0008] WO-A-9321699 discloses a CDMA radio communication system, wherein the base station transmits pilot signals with a higher power than the other data channels.

[0009] US-A-5103459 discloses a CDMA communication system, wherein pilot signals are used by the mobile units to obtain initial system synchronization and to provide robust time, frequency and phase tracking of the base station transmitted signals.

[0010] WO-A-9222161 discloses a CDMA satellite communication system, wherein continuous wave pilot signals are sent from network control stations to communication terminals. The received continuous wave pilot signals are watched by means of a pilot tone detector which monitors the frequency and amplitude of the received pilot tone signal.

[0011] The present invention has the object to provide a CDMA/TDD radio communication system capable of controlling transmission power with high precision.

[0012] The present invention solves this object by providing a CDMA/TDD radio communication system having the features of claim 1.

[0013] The invention will become more apparent from the following detailed description with reference to the drawings, wherein:

Fig. 1 is a schematic block diagram of a conventional CDMA/TDD radio communication system;

Fig. 2 is a schematic block diagram of a CDMA/TDD radio communication system according to a first embodiment of the present invention;

Fig. 3 is a typical diagram showing transmission-reception timing of a pilot signal in the first embodiment of the present invention;

Fig. 4 is a schematic block diagram of a CDMA/TDD radio communication system according to a second embodiment of the present invention; and

Fig. 5 is a typical diagram showing transmission-reception timing and a waveform of a single tone of a pilot signal in the second embodiment of the present invention.

[0014] A first embodiment of the present invention will be described hereinafter with reference to Fig. 2. In Fig. 2, reference numeral 100 represents a base station, 200 represents a mobile unit, and those that are indicated with reference numerals 3 to 14 are the same as those that are shown in the above-mentioned conventional example in Fig. 1 described above. Reference numeral 15 represents a pilot signal generating circuit for generating a pilot signal that has a constant transmission power level and is known in the mobile unit 200, 16 a pilot channel spreading circuit for spreading the pilot signal, 17 a pilot signal transmission level setting circuit for setting a transmission level of the pilot signal, 18 a pilot channel despreading circuit for obtaining a received pilot signal in the mobile unit 200, 19 a pilot signal reception level measuring circuit for measuring a reception level of the received pilot signal, 20 a data quality measuring circuit for measuring the quality of a second received data 13 such as a bit error rate (BER) or a frame error rate (PER), 21 a synchronization acquisition circuit for acquiring synchronization of spreading codes by the received pilot signal, 22 a synchronization holding circuit for holding synchronization of the spreading codes by the received pilot signal, 23 a phase detecting circuit for obtaining a phase of a carrier wave by the received pilot signal, 24 a frequency offset detecting circuit for obtaining offset of a carrier frequency in a local oscillator in the mobile unit 200, and 25 a local oscillator frequency adjusting circuit for adjusting the frequency of the local oscillator of the mobile unit 200 using the output of the frequency offset detecting circuit 24.

[0015] The operation of the CDMA/TDD radio communication system structured as described above will be described with reference to Figs. 2 and 3. In Fig. 3, reference numeral 26 represents a pilot signal transmitted from the base station 100, and 27 shows transmission-reception timing of the mobile unit 200. In Fig. 2, the pilot signal generating circuit 15 generates a pilot signal that has a constant transmission power level and is known in the mobile unit 200. This pilot signal is transmitted toward the mobile unit 200 on the transmission line 5 in a bursting manner through at least one spreading channel together with the first transmitted data 11 spread by the data channel spreading circuit 3 after being spread by the pilot channel spreading circuit 16. The pilot signal transmitted from the base station 100 through the transmission line 5 is transmitted in the time slot that the mobile unit 200 performs reception as shown in Fig. 3, and the mobile unit 200 obtains the second received data 13 by despreading the data signal by means of the data channel despreading circuit 6 from the signal received in this time slot, and obtain the received pilot signal by despreading the pilot signal by means of the pilot channel despreading circuit 18. The power of the received pilot signal is measured by the pilot signal reception level measuring circuit 19, the power of the second received data 13 is measured by the data signal reception level measuring circuit 7, and the data quality of the second received data 13 is measured by the data quality measuring circuit 20. Then, the transmission power in the power amplification circuit 10 when the second transmitted data 14 is spread by the spreading circuit 9 and transmitted to the base station 100 is controlled by the transmission power control circuit 8 taking not only the reception levels of the received pilot signal and the second received data 13, but also the quality of the data channel into consideration. Or, the transmission power is controlled based on the reception level of the received pilot signal and the data quality only. The data transmitted to the base station 100 from the mobile unit 200 through the transmission line 5 are despread by the despreading circuit 4 to obtain the first received data 12.

[0016] Further, since the pilot signal is known in the mobile unit 200, it is possible to perform the synchronization acquisition and synchronization holding of the spread signal by the synchronization acquisition circuit 21 and the synchronization holding circuit 22, the phase detection of the carrier wave by the phase detecting circuit 23, the detection of frequency offset in the local oscillator by the frequency offset detecting circuit 24, and the adjustment for compensating for the shift of the carrier frequency attendant upon Doppler effect from the detected frequency offset by means of the local oscillator frequency adjusting circuit 25 by using the received pilot signal.

[0017] Furthermore, in the base station 100, it is possible that the pilot signal transmission level setting circuit 17 lowers a relative level of the interference from the other spreading channels in the received pilot signal by making the transmission power level of the pilot signal higher than any one of the signal levels of the other spreading channels. With this, it is possible to improve the precision of the transmission power control, the synchronization acquisition, the synchronization holding, the phase detection, the frequency offset detection and the local oscillator frequency adjustment which are described previously.

[0018] Further, optional data sequence is assumed for a pilot signal generated by the pilot signal generating circuit 15 of the base station 100, but the pilot signal may be formed of data sequence of all "1" or "0". In this case, the circuit configurations of the pilot signal generating circuit 15, the pilot signal reception level measuring circuit 19, the synchronization acquisition circuit 21, the synchronization holding circuit 22, the phase detecting circuit 23, the frequency offset detecting circuit 24 and the local oscillator frequency adjusting circuit 25 become simple, so that it is possible to curtail the circuit scale.

[0019] As described above, according to the embodiment described above, it is possible to estimate the attenuation of the transmission line 5 accurately because the transmission power of the pilot signal transmitted from the base station 100 toward respective mobile units 200 is constant and the pilot signal is known in the respective mobile units 200, and, even when Rayleigh fading is generated with the movement of the mobile unit 200 and the attenuation of the transmission line 5 changes suddenly, such matters can be followed by the pilot signal.

[0020] A second embodiment of the present invention will be described hereinafter with reference to Fig. 4. In Fig. 4, reference numeral 1100 represents a base station, 1200 represents a mobile unit, and those that are indicated with reference numerals 3 to 14 are the same as those that are shown in the conventional example in Fig. 1 described above except the control in the transmission power control circuit 8. Reference numeral 115 represents a pilot signal generating circuit for generating a pilot signal that has a constant transmission power level and is known in the mobile unit 1200, 116 a pilot channel spreading circuit for spreading the pilot signal, 117 a pilot signal transmission level setting circuit for setting the transmission level of the pilot signal, 118 a pilot channel despreading circuit for obtaining the received pilot signal in the mobile unit 1200, 119 a pilot signal reception level measuring circuit for measuring the reception level of the received pilot signal, 120 a data quality measuring circuit for measuring the quality of the second received data 13 such as a bit error rate (BER) or a frame error rate (FER), 121 a synchronization acquisition circuit for acquiring the synchronization of spreading codes by the received pilot signal, 122 a synchronization holding circuit for holding the synchronization of spreading codes by the received pilot signal, 123 a phase detecting circuit for obtaining the phase of the carrier wave by the received pilot signal, 124 a frequency offset detecting circuit for obtaining the offset of the carrier frequency in a local oscillator of the mobile unit 1200, 125 a local oscillator frequency adjusting circuit for adjusting the frequency of the local oscillator of the mobile unit 1200 using the output of the frequency offset detecting circuit 124, 126 a single tone generating circuit provided in the base station 1100, 127 a single tone detecting circuit for taking a single tone (a single sine wave) out of the received signal, 128 a single tone level measuring circuit for measuring a single tone reception power level, and 129 a single tone removing circuit for removing single tone components from the received signal.

[0021] The operation of the CDMA/TDD radio communication system thus structured will be described with reference to Figs. 4 and 5. In Fig. 5, reference numeral 130 represents transmission-reception timing of the mobile unit 1200, 131 a pilot signal transmitted from the base station 1100, and 132 a single tone transmitted from the base station 1100. In Fig. 4, the pilot signal generating circuit 115 generates the pilot signal that has a constant transmission power level and is known in the mobile unit 1200. This pilot signal is transmitted toward the mobile unit 1200 on the transmission line 5 in a bursting manner through at least one spreading channel together with the first transmitted data 11 spread by the data channel spreading circuit 3 after being spread by the pilot channel spreading circuit 116. The pilot signal transmitted from the base station 1100 through the transmission line 5 is transmitted in the time slot that the mobile unit 1200 performs reception as shown in Fig. 5, and the mobile unit 1200, after removing the single tone first by the single tone removing circuit 129 from the signal received in this time slot, obtains the second received data 13 by spreading the data signal by the data channel despreading circuit 6 and obtains the received pilot signal by spreading the data signal by the pilot channel despreading circuit 118. The reception power of the received pilot signal is measured by the pilot signal reception level measuring circuit 119, the received power of the second received data 13 is measured by the data signal reception level measuring circuit 7, and the data quality of the second received data 13 is measured by the data quality measuring circuit 120. Then, the transmission power in the power amplification circuit 10 when the second transmitted data 14 are spread by the spreading circuit 9 and transmitted to the base station 1100 is controlled by the transmission power control circuit 8 taking not only the reception levels of the received pilot signal and the second received data 13, but also the quality of the data channel into consideration. Otherwise, control is made based on the reception level of the received pilot signal and the data quality only. The data transmitted from the mobile unit 1200 to the base station 1100 through the transmission line 5 are despread by means of the despreading circuit 4 to obtain the first received data 12.

[0022] On the other hand, a single tone 132 such as shown in Fig. 5 is always transmitted from the single tone generating circuit 126 in the base station 1100, and the mobile unit 1200 can follow even a sudden change in a transmission line state such as shadowing even in the time slot for performing transmission by monitoring the state of the transmission line 5 from this single tone. Namely, the single tone transmitted from the base station 1100 is detected by the single tone detecting circuit 127 of the mobile unit 1200 and the reception level thereof is measured by the single tone level measuring circuit 128, and the transmission power control circuit 8 controls the transmission power in the transmission power amplification circuit 10 taking the reception level of the measured single tone, the reception level of the received pilot signal described above, the reception level of the data signal and/or the data quality into consideration.

[0023] Further, since the pilot signal is known in the mobile unit 1200, it is possible to perform the synchronization acquisition and synchronization holding of the spread signal by the synchronization acquisition circuit 121 and the synchronization holding circuit 122, the detection of the phase of the carrier wave by the phase detecting circuit 123, the detection of frequency offset in the local oscillator by the frequency offset detecting circuit 124, and the adjustment for compensating for the shift of the carrier frequency attendant upon Doppler effect from the frequency offset detected by the local oscillator frequency adjusting circuit 125 using the received pilot signal.

[0024] Furthermore, in the base station 1100, the pilot signal transmission level setting circuit 117 can lower the relative level of interference by another spreading channel in the received pilot signal by making the transmission power level of the pilot signal higher than the signal level of other spreading channels. With this, it is possible to improve precision of the transmission power control, the synchronization acquisition, the synchronization holding, the phase detection, the frequency offset detection and the local oscillator frequency adjustment described above.

[0025] Further, although optional data sequence is assumed for the pilot signal generated by the pilot signal generating circuit 115 of the base station 1100, the pilot signal may also be formed of the data sequence of all "1" or "0". In this case, the circuit configurations of the pilot signal generating circuit 115, the pilot signal reception level measuring circuit 119, the synchronization acquisition circuit 121, the synchronization holding circuit 122, the phase detecting circuit 123, the frequency offset detecting circuit 124 and the local oscillator frequency adjusting circuit 125 become simple, so that it is possible to curtail the circuit scale.

[0026] As described above, according to the second embodiment, it is possible to estimate the attenuation of the transmission line 5 accurately because the transmission power level of the pilot signal transmitted from the base station 1100 toward respective mobile units 1200 is constant and the pilot signal is known in the mobile units 1200, and, even when Rayleigh fading is generated and the attenuation of the transmission line 5 is changed suddenly attendant upon movement of the mobile unit 1200, such matters can be followed by the pilot signal. Further, since the single tone having a constant transmission power level and a single frequency is always transmitted from the base station 1100 toward respective mobile units 1200, respective mobile units 1200 are able to monitor the state of the transmission line 5 also in the time slot for performing transmission and to follow a sudden state change of the transmission line such as shadowing.

Claims

1. A CDMA/TDD radio communication system comprising a base station (100, 1100) and one or more mobile units (200, 1200), wherein

said base station (100, 1100) comprises:

pilot signal generating means (15, 115) for generating a pilot signal (26, 131) that has a constant transmission power level for transmission to said mobile units (200, 1200); and

pilot signal transmitting means (16, 116) for transmitting said pilot signal (26, 131) in a bursting manner through at least one spread channel (5); and

each of said mobile units (200, 1200) comprises:

power measuring means (19, 119) adapted to measure the reception power level of said pilot signal (26, 131) and

transmission power control means (8) adapted to control the transmission power based on the measured power level of said pilot signal.

characterized in that
said pilot signal transmitting means (16, 116) is adapted for transmitting said pilot signal (26, 131) with a transmission power which is larger than the transmission power of a signal of any other spread channel.

2. The communication system according to claim 1, **characterized in that** each of said mobile units (200, 1200) further comprises synchronization acquisition means (21, 121) adapted to acquire synchronization information on spread codes using the pilot signal (26, 131) transmitted from said base station (100, 1100).

3. The communication system according to claim 1 or 2, **characterized in that** each of said mobile units (200, 1200) further comprises synchronization storage means (22, 122) adapted to store synchronization information on spread codes using the pilot signal (26, 131) transmitted from said base station

(100, 1100).

4. The communication system according to any one of claims 1 to 3, **characterized in that** each of said mobile units (200, 1200) further comprises:

phase detecting means (23, 123) adapted to obtain a phase of a carrier wave using the pilot signal (26, 131) transmitted from said base station (100, 1100); and

despreading means (6) adapted to demodulate data in accordance with an output signal of said phase detecting means (23, 123).

5. The communication system according to any one of claims 1 to 4, **characterized in that** each of mobile units (200, 1200) further comprises:

frequency offset detecting means (24, 124) adapted to obtain an offset of a carrier frequency in a local oscillator of said mobile unit (200, 1200) based on the pilot signal (26, 131) transmitted from said base station (100, 1100); and frequency adjusting means (25, 125) adapted to adjust a frequency of the local oscillator of said mobile unit (200, 1200) in accordance with an output signal of said frequency offset detecting means (24, 124).

6. The communication system according to any one of claims 1 to 5, **characterized in that** each of said mobile units (200, 1200) further comprises data quality measuring means (20, 120) adapted to measure the quality of received data; and said transmission power control means (8) controls the transmission power additionally based on output signals of said data quality measuring means (20, 120).

7. The communication system according to any one of claims 1 to 6, **characterized in that**:

each of said mobile units (200, 1200) further comprises data signal level measuring means (7) adapted to measure the reception power of a data signal transmitted to said mobile unit (200, 1200); and

said transmission power control means (8) controls the transmission power additionally on the basis of output signals of said data signal level measuring means (7).

8. The communication system according to any one of claims 1 to 7, **characterized in that**
said base station (1100) further comprises single tone transmission means adapted to transmit a single tone (132) having a constant transmission power level and a signal frequency to said mobile units (1200);
each of said mobile units (1200) further comprises single tone level measuring means (128) adapted to measure a reception power of said single tone (132); and
said transmission power control means (8) controls the transmission power additionally on the basis of output signals of said single tone level measuring means (128).

9. The communication system according to any one of claims 1 to 8, **characterized in that** said pilot signal generating means (15, 115) generates a data sequence of all "1" or a data sequence of all "0".

Patentansprüche

1. CDMA/TDD-Funkkommunikationssystem, das eine Basisstation (100, 1100) und eine oder mehrere Mobileinheiten (200, 1200) umfasst, wobei:

die Basisstation (100, 1100) umfasst:

eine Pilotsignal-Erzeugungseinrichtung (15, 115), die ein Pilotsignal (26, 131) erzeugt, das einen konstanten Sendeleistungspegel für die Übertragung zu den Mobileinheiten (200, 1200) aufweist; und

eine Pilotsignal-Übertragungseinrichtung (16, 116), die das Pilotsignal (26, 131) in einem Burstverfahren über wenigstens einen Spreizkanal (5) überträgt; und

wobei jede der Mobileinheiten (200, 1200) umfasst:

eine Leistungsmesseinrichtung (19, 119), die den Empfangsleistungspegel des Pilotsignals (26, 131) misst, und

eine Sendeleistung-Steuereinrichtung (8), die die Sendeleistung auf der Basis des gemessenen Leistungspegels des Pilotsignals steuert;

dadurch gekennzeichnet, dass:

die Pilotsignal-Übertragungseinrichtung (16, 116) das Pilotsignal (26, 131) mit einer Sendeleistung überträgt, die größer ist als die Sendeleistung eines Signals eines beliebigen anderen Spreizkanals.

2. Kommunikationssystem nach Anspruch 1, **da-**

durch gekennzeichnet, dass jede der Mobileinheiten (200, 1200) weiterhin eine Synchronisation-Erfassungseinrichtung (21, 121) umfasst, die Synchronisationsinformation zu Spreizcodes unter Verwendung des von der Basisstation (100, 1100) übertragenen Pilotsignals (26, 131) erfasst.

3. Kommunikationssystem nach Anspruch 1 oder 2, **dadurch gekennzeichnet, dass** jede der Mobileinheiten (200, 1200) weiterhin eine Synchronisation-Speichereinrichtung (22, 122) umfasst, die Synchronisationsinformation zu Spreizcodes unter Verwendung des von der Basisstation (100, 1100) übertragenen Pilotsignals (26, 131) speichert.

4. Kommunikationssystem nach einem der Ansprüche 1 bis 3, **dadurch gekennzeichnet, dass** jede der Mobileinheiten (200, 1200) weiterhin umfasst:

eine Phasen-Detektionseinrichtung (23, 123), die eine Phase einer Trägerwelle unter Verwendung des von der Basisstation (100, 1100) übertragenen Pilotsignals (26, 131) bestimmt, und

eine Entspreizeinrichtung (6), die Daten in Übereinstimmung mit einem Ausgangssignal der Phasen-Detektionseinrichtung (23, 123) demoduliert.

5. Kommunikationssystem nach einem der Ansprüche 1 bis 4, **dadurch gekennzeichnet, dass** jede der Mobileinheiten (200, 1200) weiterhin umfasst:

eine Frequenzverschiebung-Detektionseinrichtung (24,124), die eine Verschiebung einer Trägerfrequenz in einem Lokaloszillator der Mobileinheit (200, 1200) auf der Basis des von der Basisstation (1000, 1100) übertragenen Pilotsignals (26, 131) bestimmt; und

eine Frequenz-Einstellungseinrichtung (25, 125), die eine Frequenz des Lokaloszillators der Mobileinheit (200, 1200) in Übereinstimmung mit einem Ausgangssignal der Frequenzverschiebung-Detektionseinrichtung (24, 124) einstellt.

6. Kommunikationssystem nach einem der Ansprüche 1 bis 5, **dadurch gekennzeichnet, dass** jede der Mobileinheiten (200, 1200) weiterhin eine Datenqualität-Messeinrichtung (20, 120) umfasst, die die Qualität empfangener Daten misst; und
die Sendeleistung-Steuereinrichtung (8) die Sendeleistung zusätzlich auf der Basis von Ausgangssignalen der Datenqualität-Messeinrichtung (20,120) steuert.

7. Kommunikationssystem nach einem der Ansprüche 1 bis 6, **dadurch gekennzeichnet, dass**:

jede der Mobileinheiten (200, 1200) weiterhin eine Datensignalpegel-Messeinrichtung (7) umfasst, die die Empfangsleistung eines zu der Mobileinheit (200, 1200) übertragenen Datensignals misst; und

die Sendeleistung-Steuereinrichtung (8) die Sendeleistung zusätzlich auf der Basis von Ausgangssignalen der Datensignalpegel-Messeinrichtung (7) steuert.

8. Kommunikationssystem nach einem der Ansprüche 1 bis 7, **dadurch gekennzeichnet, dass**:

die Basisstation (1100) weiterhin eine Einfachton-Übertragungseinrichtung umfasst, die einen Einfachton (132) mit einem konstanten Sendeleistungspegel und einer Signalfrequenz zu den Mobileinheiten (1200) überträgt;

jede der Mobileinheiten (1200) weiterhin eine Einfachtonpegel-Messeinrichtung (128) umfasst, die eine Empfangsleistung des Einfachtons (132) misst; und

die Sendeleistung-Steuereinrichtung (8) die Sendeleistung zusätzlich auf der Basis von Ausgangssignalen der Einfachtonpegel-Messeinrichtung (128) steuert.

9. Kommunikationssystem nach einem der Ansprüche 1 bis 8, **dadurch gekennzeichnet, dass** die Pilotsignal-Erzeugungseinrichtung (15, 115) eine Datensequenz mit ausschließlich "1"-en oder eine Datensequenz mit ausschließlich "0"-en erzeugt.

Revendications

1. Système de communications radio de type CDMA/TDD comprenant une station de base (100, 1100) et une ou plusieurs unités mobiles (200, 1200), dans lequel

ladite station de base (100, 1100) comprend :

un moyen de génération de signal pilote (15, 115) destiné à générer un signal pilote (26, 131) qui présente un niveau de puissance d'émission constant en vue d'une émission vers lesdites unités mobiles (200, 1200), et
un moyen d'émission de signal pilote (16, 116) destiné à émettre ledit signal pilote (26, 131) en salves par l'intermédiaire d'au moins un canal à étalement (5), et
chacune desdites unités mobiles (200, 1200)

comprend :

un moyen de mesure de puissance (19, 119) conçu pour mesurer le niveau de puissance de réception dudit signal pilote (26, 131) et
un moyen de commande de puissance d'émission (8) conçu pour commander la puissance d'émission sur la base du niveau de puissance mesuré dudit signal pilote,

caractérisé en ce que
ledit moyen d'émission de signal pilote (16, 116) est conçu pour émettre ledit signal pilote (26, 131) avec une puissance d'émission qui est plus grande que la puissance d'émission d'un signal d'un autre canal à étalement quelconque.

2. Système de communications selon la revendication 1, **caractérisé en ce que** chacune desdites unités mobiles (200, 1200) comprend en outre un moyen d'acquisition de synchronisation (21, 121) conçu pour acquérir des informations de synchronisation sur des codes d'étalement en utilisant le signal pilote (26, 131) émis depuis ladite station de base (100, 1100).

3. Système de communications selon la revendication 1 ou 2, **caractérisé en ce que** chacune desdites unités mobiles (200, 1200) comprend en outre un moyen de mémorisation de synchronisation (22, 122) conçu pour mémoriser des informations de synchronisation sur des codes d'étalement en utilisant le signal pilote (26, 131) émis depuis ladite station de base (100, 1100).

4. Système de communications selon l'une quelconque des revendications 1 à 3, **caractérisé en ce que** chacune desdites unités mobiles (200, 1200) comprend en outre :

un moyen de détection de phase (23, 123) conçu pour obtenir une phase d'une onde porteuse en utilisant le signal pilote (26, 131) émis depuis ladite station de base (100, 1100), et
un moyen de regroupement (6) conçu pour démoduler des données conformément à un signal de sortie dudit moyen de détection de phase (23, 123).

5. Système de communications selon l'une quelconque des revendications 1 à 4, **caractérisé en ce que** chacune des unités mobiles (200, 1200) comprend en outre :

un moyen de détection de décalage de fréquence (24, 124) conçu pour obtenir un décalage d'une fréquence porteuse dans un oscillateur local d'une dite unité mobile (200, 1200) sur la base du signal pilote (26, 131) émis depuis ladite station de base (100, 1100), et
un moyen de réglage de fréquence (25, 125) conçu pour régler une fréquence de l'oscillateur local de ladite unité mobile (200, 1200) conformément à un signal de sortie dudit moyen de détection de décalage de fréquence (24, 124).

6. Système de communications selon l'une quelconque des revendications 1 à 5, **caractérisé en ce que** chacune desdites unités mobiles (200, 1200) comprend en outre un moyen de mesure de qualité de données (20, 120) conçu pour mesurer la qualité des données reçues, et ledit moyen de commande de puissance d'émission (8) commande en outre la puissance d'émission sur la base de signaux de sortie dudit moyen de mesure de qualité de données (20, 120).

7. Système de communications selon l'une quelconque des revendications 1 à 6, **caractérisé en ce que** :

chacune desdites unités mobiles (200, 1200) comprend en outre un moyen de mesure de niveau de signal de données (7) conçu pour mesurer la puissance de réception d'un signal de données émis vers ladite unité mobile (200, 1200), et
ledit moyen de commande de puissance d'émission (8) commande en outre la puissance d'émission sur la base des signaux de sortie dudit moyen de mesure de niveau de signal de données (7).

8. Système de communications selon l'une quelconque des revendications 1 à 7, **caractérisé en ce que**
ladite station de base (1100) comprend en outre un moyen d'émission à une seule tonalité conçu pour émettre une seule tonalité (132) présentant un niveau de puissance et une fréquence de signal d'émission constants vers lesdites unités mobiles (1200),
chacune desdites unités mobiles (1200) comprend en outre un moyen de mesure de niveau de tonalité unique (128) conçu pour mesurer une puissance de réception de ladite seule tonalité (132), et
ledit moyen de commande de puissance d'émission (8) commande en outre la puissance d'émission sur la base de signaux de sortie dudit moyen de mesure de niveau de tonalité unique (128).

9. Système de communications selon l'une quelconque des revendications 1 à 8, **caractérisé en ce**

que ledit moyen de génération de signal pilote (15, 115) génère une séquence de données entièrement constituée de "1" ou une séquence de données entièrement constituée de "0".

FIG.1 PRIOR ART

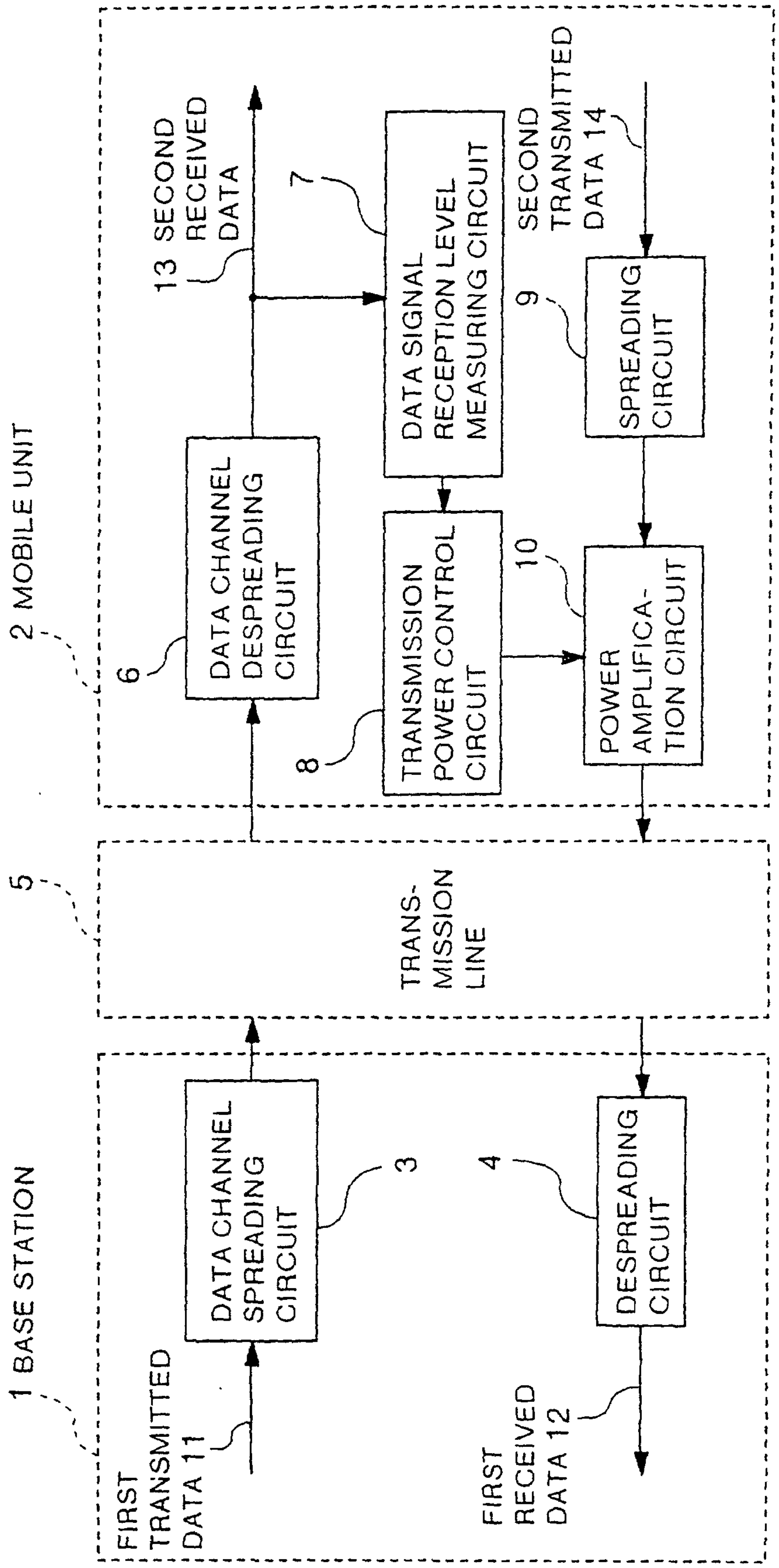


FIG.2

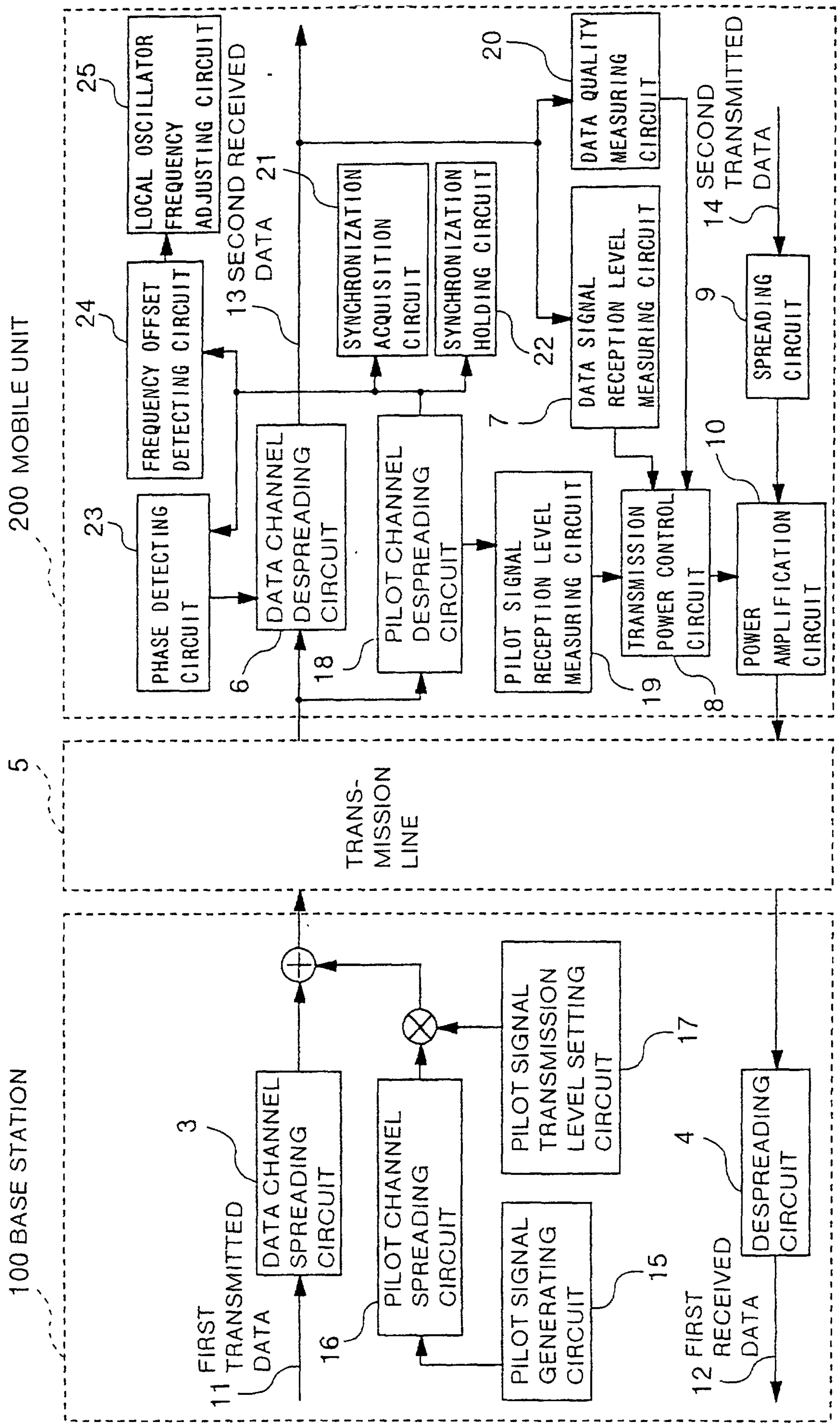

100 BASE STATION
11 FIRST TRANSMITTED DATA
3
DATA CHANNEL SPREADING CIRCUIT
16
PILOT CHANNEL SPREADING CIRCUIT
PILOT SIGNAL GENERATING CIRCUIT
15
PILOT SIGNAL TRANSMISSION LEVEL SETTING CIRCUIT
17
4
DESPREADING CIRCUIT
12 FIRST RECEIVED DATA
5
TRANS-MISSION LINE
200 MOBILE UNIT
23
PHASE DETECTING CIRCUIT
24
FREQUENCY OFFSET DETECTING CIRCUIT
25
LOCAL OSCILLATOR FREQUENCY ADJUSTING CIRCUIT
6
DATA CHANNEL DESPREADING CIRCUIT
13 SECOND RECEIVED DATA
21
18
PILOT CHANNEL DESPREADING CIRCUIT
SYNCHRONIZATION ACQUISITION CIRCUIT
SYNCHRONIZATION HOLDING CIRCUIT
22
PILOT SIGNAL RECEPTION LEVEL MEASURING CIRCUIT
19
7
DATA SIGNAL RECEPTION LEVEL MEASURING CIRCUIT
20
DATA QUALITY MEASURING CIRCUIT
TRANSMISSION POWER CONTROL CIRCUIT
8
9
SPREADING CIRCUIT
14 SECOND TRANSMITTED DATA
10
POWER AMPLIFICATION CIRCUIT

FIG.3

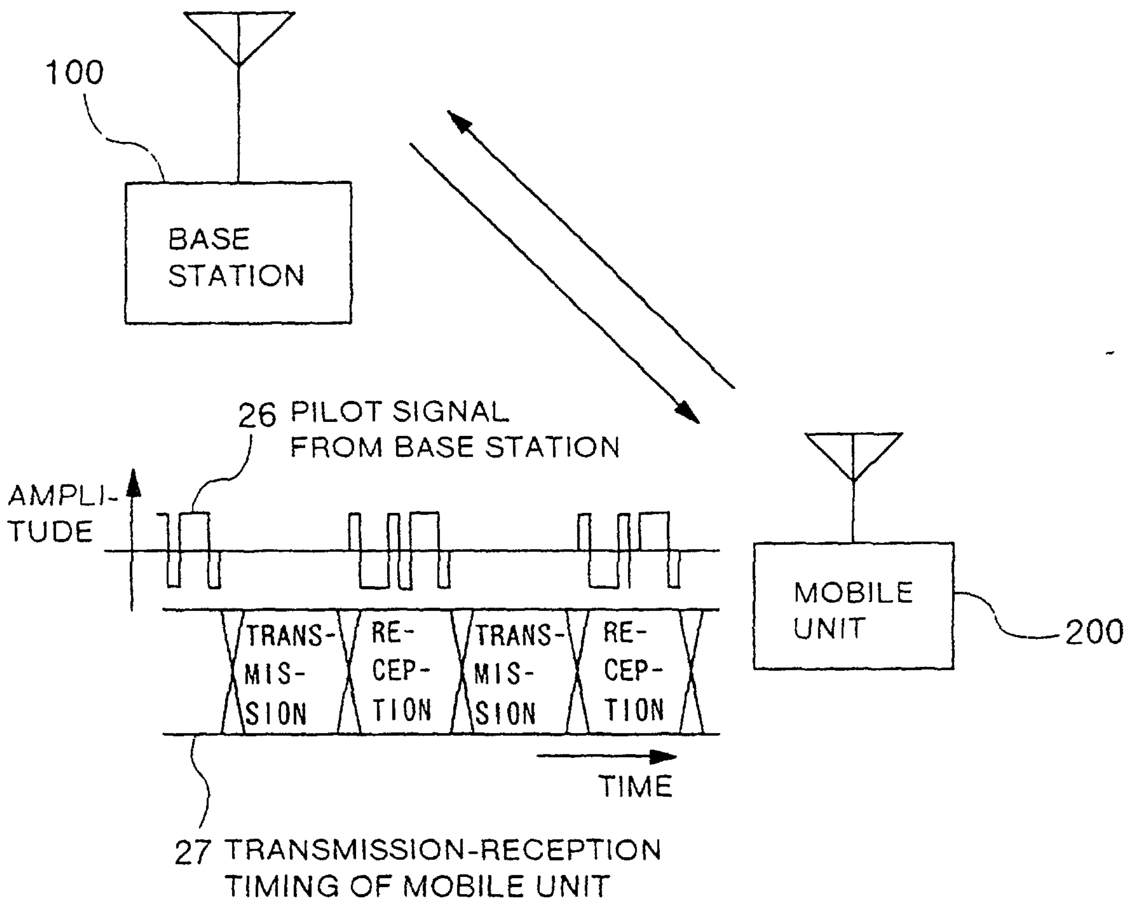

100
BASE STATION
26 PILOT SIGNAL FROM BASE STATION
AMPLI-TUDE
TRANS-MIS-SION
RE-CEP-TION
TRANS-MIS-SION
RE-CEP-TION
TIME
27 TRANSMISSION-RECEPTION TIMING OF MOBILE UNIT
MOBILE UNIT
200

FIG.4

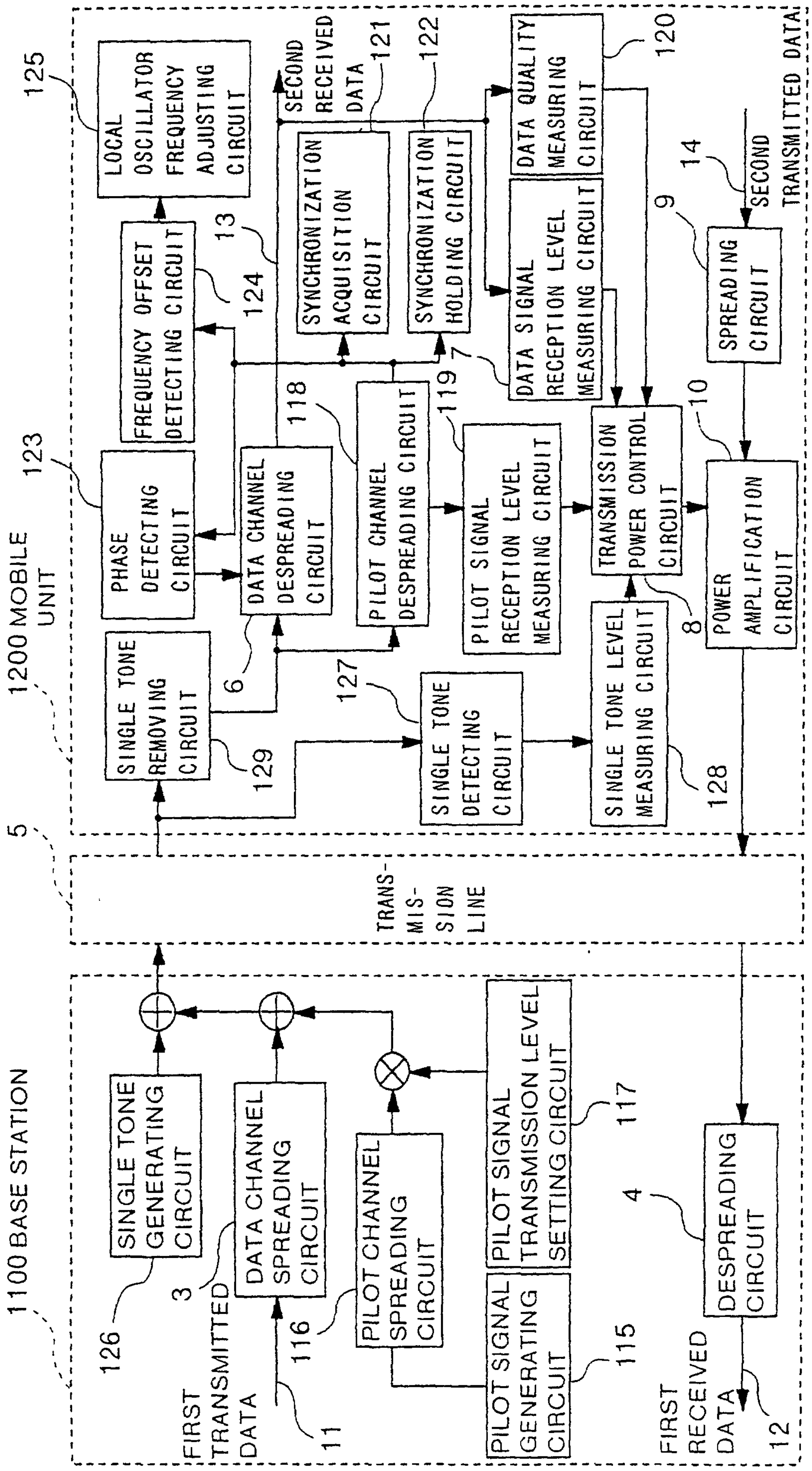
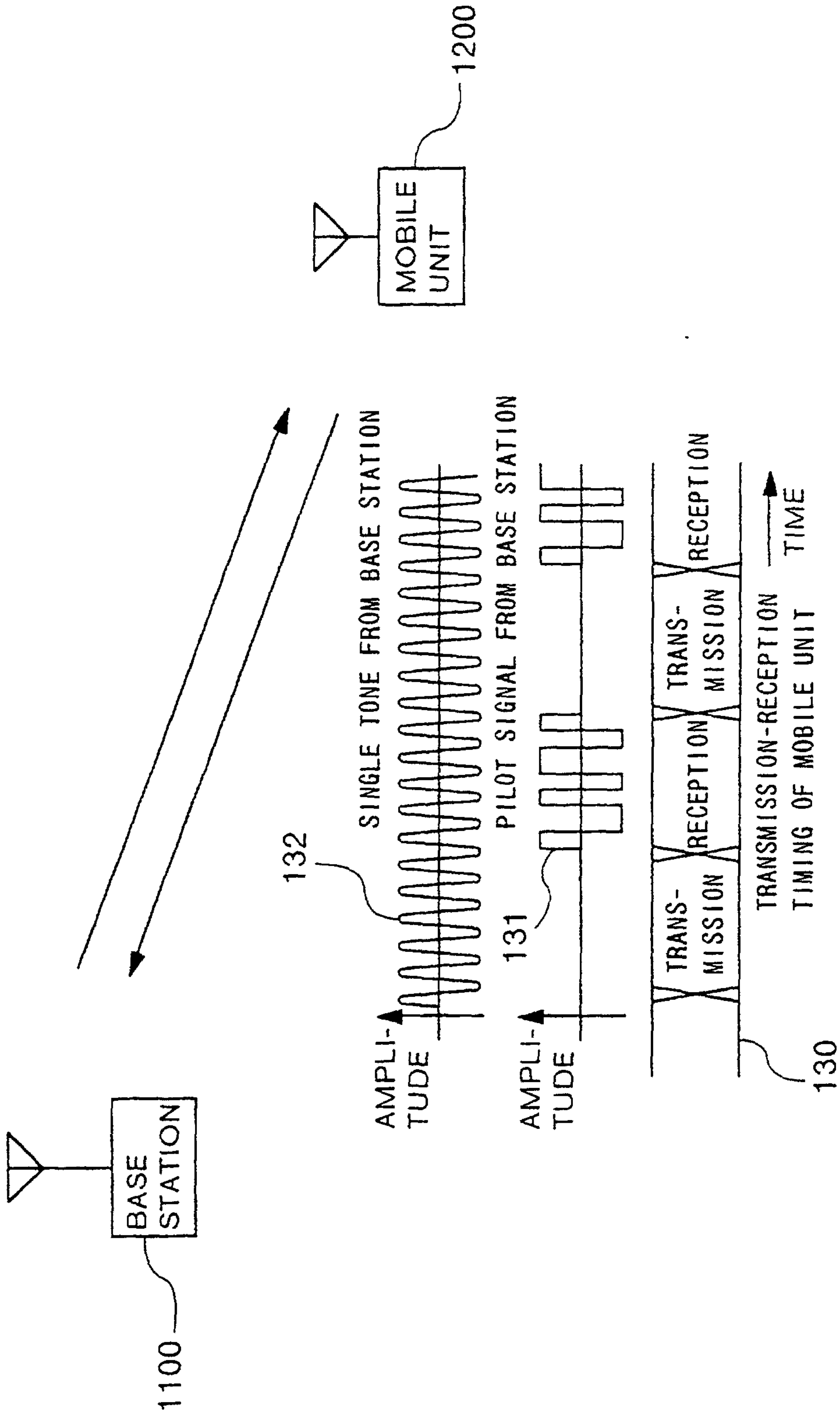

1200 MOBILE UNIT
125
LOCAL OSCILLATOR FREQUENCY ADJUSTING CIRCUIT
SECOND RECEIVED DATA
121
122
DATA QUALITY MEASURING CIRCUIT
120
FREQUENCY OFFSET DETECTING CIRCUIT
124
13
SYNCHRONIZATION ACQUISITION CIRCUIT
SYNCHRONIZATION HOLDING CIRCUIT
DATA SIGNAL RECEPTION LEVEL MEASURING CIRCUIT
7
9
14
SECOND TRANSMITTED DATA
SPREADING CIRCUIT
123
PHASE DETECTING CIRCUIT
DATA CHANNEL DESPREADING CIRCUIT
118
PILOT CHANNEL DESPREADING CIRCUIT
119
PILOT SIGNAL RECEPTION LEVEL MEASURING CIRCUIT
TRANSMISSION POWER CONTROL CIRCUIT
10
POWER AMPLIFICATION CIRCUIT
8
SINGLE TONE REMOVING CIRCUIT
6
129
127
SINGLE TONE DETECTING CIRCUIT
SINGLE TONE LEVEL MEASURING CIRCUIT
128
5
TRANS-MIS-SION LINE
1100 BASE STATION
126
SINGLE TONE GENERATING CIRCUIT
3
DATA CHANNEL SPREADING CIRCUIT
116
PILOT CHANNEL SPREADING CIRCUIT
PILOT SIGNAL TRANSMISSION LEVEL SETTING CIRCUIT
117
PILOT SIGNAL GENERATING CIRCUIT
115
FIRST TRANSMITTED DATA
11
4
DESPREADING CIRCUIT
FIRST RECEIVED DATA
12

FIG.5



BASE STATION
1100
MOBILE UNIT
1200
SINGLE TONE FROM BASE STATION
132
AMPLITUDE
PILOT SIGNAL FROM BASE STATION
131
AMPLITUDE
TRANSMISSION
RECEPTION
TRANSMISSION
RECEPTION
TIME
TRANSMISSION-RECEPTION TIMING OF MOBILE UNIT
130